

## STACKING TRAY FOR FLAT MAIL ITEMS

### CONTINUATION DATA

The present application claims priority to German Patent Application DE 10303979.1, filed 01/31/2003, which is herein incorporated by reference.

### BACKGROUND OF THE INVENTION

The present invention relates to a stacking tray for items. The stacking tray may be narrow and the items may be mail items. The mail items may further be flat. The stacking tray includes a receiving area defined by a base and lateral side walls which cooperate to form the area for accommodating the items therein.

One application for the sorting arts is the sorting of mail items. A latter and perhaps final sorting sequence often entails sorting items by address according to a select delivery route. Given a large number of deliver addresses in a delivery route and the need to sort mail items to each of said addresses, stacking trays assigned to each destination address are accordingly small and/or narrow. Therefore, for practical operating purposes, the stacking trays must be emptied relatively quickly and efficiently. The quickness is to ensure that the sorted mail items are not deformed and the efficiency entails that the stack remain in order of sort.

Mail items are often accommodated in an upright position. Stacking trays accommodating such items have traditionally been emptied manually, i.e. the stack support has been swung upward and the stack held by the operator and slid onto a mail receptacle or into a container.

This manual operation includes several drawbacks, including the limitations associated with manual labor. Such limitations include human error, human fatigue, inconsistent handling of mail items, costs and other resources associated with continuous staffing, and so forth. Accordingly, a need exists in the art for a method and apparatus wherein such stacking trays are emptied in a controlled and automated manner.

## SUMMARY OF THE INVENTION

An object of the present invention is to create a generic narrow stacking tray which can be emptied quickly and automatically and which permits transportation of the stack of mail from successive stacking trays with optimum retention of the stack formation for further processing. The present invention may, of course, be used for other items besides flat mail items as would be envisioned by one skilled in the art. The present invention will be described with respect to use with flat mail items.

This and other objects are achieved by the present system and method wherein, ahead of the stacking location in the direction of stacking there is disposed a movable, driven pusher unit for emptying the stacking tray. For emptying, the pusher unit drive can be controlled in such a way that the pusher unit moves up to the narrow stack and rapidly slides the stack out over the stacking base and the stack support drive can be controlled in such a way that the stack support covers a greater distance than the pusher unit in the course of the emptying process. As a result, the narrow stack is rapidly pushed out of the stacking tray over the stacking base. During emptying, jamming of the stack between the pusher unit and stack support is eliminated so that the stack can drop down.

Thus it is advantageous to provide, in the stacking tray, a level sensor which produces an emptying signal when a specified stack thickness and/or number of mail items is reached. This emptying signal is transmitted to the drive controls of the pusher unit and initiates the appropriate movement processes, thereby preventing the relevant stacking tray from overflowing.

It is also advantageous if a receiving mechanism to collect the stack of mail from the stacking tray is provided outside the tray at its open end in the stacking direction.

In addition, it is particularly advantageous that the pusher unit drive can be controlled in such a way that, at the open end of the stacking tray, usually defined by an edge to a base, an acceleration is exerted on the pusher unit and therefore on the stack of mail items which permits no significant deformation within the stack due to the mass inertia of the mail items and the friction between the mail items during displacement of the stack out over the end of the stacking base and during its drop onto the receiving mechanism. For a plurality of stacking trays it is advantageous to provide, as a receiving

mechanism, a sectional conveyor inclined from the vertical in the emptying direction for transporting the stack of mail items to the distribution unit, there being disposed at the lower lateral boundary of the sectional conveyor a narrow conveyor belt inclined at an angle of approximately  $90^{\circ}$  on which the mail items are supported by their narrow sides, thereby ensuring that the alignment and orientation of the mail items with respect to one another is maintained. Until such time as all the stacking trays have been emptied, the section conveyor may be stationary, with generally one stacking tray being assigned to each section. When all the stacking trays have been emptied onto the sectional conveyor, the conveyor is set in motion.

The present invention further comprises An apparatus for accommodating items, comprising: a base for supporting said items, said base comprising walls defining an edge and a drop; a first drive; a first wall for providing rear lateral support to said items, said first wall functionally associated with said first drive such that when engaged said first drive causes said first wall to move in a lateral direction past edge; a second drive; a second wall for providing front lateral support, said second wall functionally associated with said second drive so as to move said second wall in response to an incoming item, and said second drive functionally associated with said first drive so as to move said second wall in concert with said first wall such that said items are pushed past said edge; and a receiving area for accommodating said items, said area defined by cooperation of said first wall, said second wall, and said base.

The present invention still further comprises a method for emptying a stacking tray, comprising the steps of: receiving items in a receiving area, said area defined by a first and second side driven lateral side wall and base running therebetween, said base further comprising walls defining an edge and a drop; moving said second wall laterally away from said first wall so as to accommodate newly arriving items in said receiving area; monitoring when a select number of items or total items thickness is accommodated within said receiving area; laterally displacing said first and second wall along said base such that items within said receiving area are pushed past said edge and caused to drop from said base when a preselect number of items or total thickness of items is monitored.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The novel features and method steps believed characteristic of the invention are set out in the claims below. The invention itself, however, as well as other features and advantages thereof, are best understood by reference to the detailed description, wherein

FIG 1 depicts a perspective view of two cascaded sorting machines in which the mail items are conveyed to stacking trays via sorting gates; and

FIGs 2a and 2b depict a lateral cross-section through a stacking tray with emptying device and sectional conveyor taking away the sorted stacks of mail items.

#### DETAILED DESCRIPTION OF THE INVENTION

With reference to figure 1, mail items for a specific zone are to be sorted to individual delivery points. This takes place on two sorting machines 10,20 in which the mail items are fed to the end points via sorting gates. Mail containers 12 with mail items of the delivery zone are fed via a roller conveyor track 11 to the input portion of the first sorting machine 10, comprising a feeder bed 13 and a singling device 14. There they are unloaded and the mail items are placed on the feeder bed 13 in an upright position. The stack of mail items is then gradually pushed to the singling device 14 where the front most mail item is pulled off. When the destination address has been aligned and read, the singled mail items are fed via a letter run 15 to the sorting section 16 in which the mail items are sorted via gates controlled according to the read destination address into adjacent end points implemented as stacking trays 17. Each stacking tray 17 is assigned to a specific group of delivery points.

If all the mail items for the current zone have been sorted away, the stacking trays 17 are emptied into mail containers 12 which are then transported via another roller conveyor 18 to the input portion 19 of the second sorting machine 20. In this sorting machine 20, after the letter run 21, the mail items are sorted group by group to the individual delivery points in delivery sequence order in the sorting section 22, i.e. the serially adjacent end points implemented as stacking trays 23 are assigned to the delivery points in delivery sequence order. The emptied mail containers 12 are again fed via an upper conveyor track 25 to the first sorting machine 10 in order to load in the sorted mail

item groups from the stacking trays 17. As each delivery point 20 is assigned a stacking tray 23 in the second sorting machine, and therefore the mail volume for each stacking tray 23 is relatively low, they have a limited capacity (approx. 30 - 50 mm length).

As both the destination addresses and the thickness of each mail item is determined in the first sorting machine 10, it is therefore also known if the total thickness of the mail items exceeds the capacity of a stacking tray. In this case two or more stacking trays are assigned to this delivery point.

Emptying of the stacking trays 23 containing upright mail items on the sectional conveyor 24 takes place automatically and is illustrated in further detail in FIGs 2a and 2b.

As can be seen, the mail items 2 are conveyed sideways into the stacking tray 23 as end point using a stacking roller 30 at the stacking location as far as a deflector wall (not shown) where they are held in the upright position on the stacking base 31 by a driven stack support or second wall 32. The tray 23 includes a base upon which the mail items stand. The base comprises walls defining a lateral and edge 37 and drop 38. To improve the stacking process, other means aside from the stacking roller 30 can be used, as described e.g. in EP 0 143 818 B1. As the stack thickness increases, the stack support 32 moves away from the stacking location according to the measured mail thickness (driven by a drive 33 of the stack support 32) or according to a certain stack pressure against the resilience of a spring (not shown) (max. travel = tray depth). If all the supplied mail items 2 are in the stacking tray 23, the stack support 32 and an idle pusher unit or first wall 34 preceding the stacking location are simultaneously moved out away from the stacking location via the open end of the stacking tray 23. Hence, the first wall 34 may be considered a front wall and second wall 32 may be considered a rear wall in the direction of movement described herein.

The relatively rapid motion of the stack support 32 and of the pusher unit 34 is generated by appropriate drives 33,35, the stack support 32 covering a comparatively large distance and thereby preventing the stack from jamming. The drives 33,35 can be implemented in the known manner, e.g. as a linear drive or as a rack-and-pinion drive. The pusher 34 unit is implemented such that a force can be applied as evenly as possible

to the surface of all mail item formats. Due to the rapid motion and the resulting abrupt application of force to the stack, the latter is pushed over the edge 37 of the short tray base 31 without significant deformation due to the force of inertia. As jamming of the stack is eliminated, the stack drops (38) as the result of gravity onto the idle sectional conveyor 24 located outside the stacking trays 23 below the stacking bases 31 and inclined from the vertical in the unloading direction for transporting the mail stack in the sections to the distribution unit. To ensure that the mail items do not slip down from the sectional conveyor 24, at its lower lateral boundary a narrow roller track 36 inclined at an angle of approximately 90° is disposed on which the mail items 2 are supported with their narrow sides. As soon as all the stacking trays 23 have been emptied, the sectional conveyor 24 is set in motion until all the mail stacks have been transferred to the distribution unit.

A controller (not shown) may also be provided to control the drives 33, 35 of the first and second wall 34, 32, so that the two may be made to act in concert. A level sensor may also be provided (not shown) which interacts with the controller to indicate when the tray requires emptying.

The invention being thus described, it will be obvious that the same may be varied in many ways. The variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.